8203

Power Triode

NUVISTOR TYPE

ALL-CERAMIC-AND-METAL CONSTRUCTION

For Class C RF Power Amplifier and Oscillator Service, DC Pulse-Amplifier and Frequency-Multiplier Tube Applications, Including Use in Equipment in which Ability to Withstand Severe Mechanical Shock and Vibration, Compactness, and Exceptional Uniformity of Characteristics are Primary Requirements.

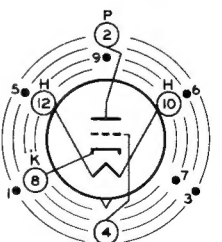
Electrical:

Heater Characteristics and Ratings:		
Voltage (AC or DC)	6.3 ±0.6	volts
Current at 6.3 volts	0.160	amp
Peak heater-cathode voltage (CCS[a] or ICAS[b] conditions):		
Heater negative with respect to cathode	100 max.	volts
Heater positive with respect to cathode	100 max.	volts
Direct Interelectrode Capacitances (Approx.):		
Grid to plate	2.2	pf
Input: G to (K,S,H)	4.2	pf
Output: P to (K,S,H)	1.6	pf
Cathode to plate	0.26	pf
Heater to cathode	1.5	pf

Mechanical:

Operating Position	Any
Type of Cathode	Coated Unipotential
Maximum Overall Length	0.800"
Maximum Seated Length	0.625"
Maximum Diameter	0.440"
Weight (Approx.)	1.9 grams
Envelope	Metal Shell MT4
Socket	See *Socket & Connector Information for RCA Nuvistor Tubes* at front of this Section
Base	Medium Ceramic-Wafer Twelvar 5-Pin (JEDEC No.E5-65)
Basing Designation for BOTTOM VIEW	12AQ

Pin 1[c] – Do Not Use
Pin 2 – Plate
Pin 3[c] – Do Not Use
Pin 4 – Grid
Pin 5[c] – Do Not Use
Pin 6[c] – Do Not Use
Pin 7[c] – Do Not Use
Pin 8 – Cathode
Pin 9[c] – Do Not Use
Pin 10 – Heater
Pin 11 – Omitted
Pin 12 – Heater



INDEX=LARGE LUG
●=SHORT PIN; IC—DO NOT USE

Characteristics, Class A_1 Amplifier:

DC Plate Supply Voltage	75	150	volts
Grid Supply Voltage	0	0	volts
Cathode Resistor	100	560	ohms
Amplification Factor	35	30	
Plate Resistance (Approx.)	2700	5000	ohms
Transconductance	13000	6000	μmhos
Plate Current	11.5	7	ma
Grid Voltage (Approx.) for plate μa = 10.	−6.5	−15	volts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[d]

and

RF POWER AMPLIFIER — Class C FM Telephony

Maximum Ratings, *Absolute-Maximum Values:*

For operation at frequencies up to 250 Mc

	CCS	ICAS	
DC Plate Supply Voltage	400[e] max.	400[e] max.	volts
DC Plate Voltage	250[e] max.	300[e] max.	volts
DC Grid Voltage:			
Negative-bias value	100 max.	100 max.	volts
Positive-bias value	0 max.	0 max.	volts
Peak-Positive Grid Voltage	5 max.	5 max.	volts
DC Cathode Current	25 max.	30 max.	ma
DC Grid Current	5 max.	6 max.	ma
Plate Dissipation	1.5 max.	1.8 max.	watts

Typical CCS Operation:

As rf power amplifier in cathode-drive circuit at 160 Mc

DC Plate-to-Grid Voltage	155	volts
DC Cathode-to-Grid Voltage	14	volts
From a grid resistor of	2700	ohms
DC Cathode Current	21	ma
DC Grid Current	5	ma
Driver Power Output (Approx.)	0.4	watt
Useful Power Output (Approx.)	1.55[f]	watts

As rf oscillator at 160 Mc

DC Plate Voltage	100	volts
DC Grid Voltage	−3.4	volts
From a grid resistor of	1500	ohms
DC Cathode Current	18	ma
DC Grid Current	2.5	ma
Useful Power Output (Approx.)	0.8[f]	watt

Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):[g]

For fixed-bias or cathode-bias operation . . 50000 max. ohms

FREQUENCY MULTIPLIER

Maximum Ratings, *Absolute-Maximum Values:*

For operation at frequencies up to 250 Mc

	CCS	ICAS	
DC Plate Supply Voltage	400[e] max.	400[e] max.	volts
DC Plate Voltage	250[e] max.	250[e] max.	volts
DC Grid Voltage:			
Negative-bias value	200 max.	200 max.	volts
Positive-bias value	0 max.	0 max.	volts
Peak-Positive Grid Voltage	5 max.	5 max.	volts
DC Cathode Current	20 max.	24 max.	ma
DC Grid Current	3 max.	4 max.	ma
Plate Dissipation	1.3 max.	1.5 max.	watts

Typical CCS Operation:

As a doubler from 80 to 160 Mc

DC Plate Voltage	125	volts
DC Grid Voltage	−70	volts
From a grid resistor of	18000	ohms
DC Cathode Current	22	ma
DC Grid Current	4	ma
Driver Power Output (Approx.)	0.25	watt
Useful Power Output (Approx.)	0.85[f]	watt

Maximum Circuit Values:

Grid-Circuit Resistance (CCS or ICAS conditions):[g]

For fixed bias or cathode-bias operation	50000 max.	ohms

DC PULSE AMPLIFIER

Maximum Ratings, *Absolute-Maximum Values:*

Peak Positive-Pulse Plate Voltage	500[e] max.	volts
DC Plate Voltage	250[e] max.	volts
DC Grid Voltage:		
Negative-bias value	100 max.	volts
Positive-bias value	0 max.	volts
Peak Positive Grid Voltage	5 max.	volts
DC Grid Current	5 max.	ma
DC Cathode Current	18 max.	ma
Peak Cathode Current:		
For duty factors up to 1 per cent	250 max.	ma
For duty factors between 1 and 50 per cent	See *Pulse Rating Chart*	
Plate Dissipation	1 max.	watt

Maximum Circuit Values:

Grid-Circuit Resistance:[g]

For fixed-bias operation	0.5 max.	megohm
For cathode-bias operation	1 max.	megohm

[a] Continuous Commercial Service.

[b] Intermittent Commercial and Amateur Service. No operating or "ON" period exceeds 5 minutes and every "ON" period is followed by an "OFF" or stand-by period of the same or greater duration.

[c] Pins 1,3,5,6,7, and 9 are of a length such that their ends do not touch the socket insertion plane.

[d] Key-down conditions per tube without amplitude modulation. Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.

[e] Under no circumstances should this absolute-maximum value be exceeded. For high-altitude operation the maximum permissible plate supply voltage and plate voltage for the 8203 are dependent on atmospheric pressure. See accompanying graph of *Low-Pressure Voltage-Breakdown Characteristics of Nuvistor Triode Base.*

[f] Measured at load of output circuit.

[g] For operation at metal-shell temperature of 150° C. For operation at other metal-shell temperatures, see accompanying *Grid-Circuit Resistance Rating Chart.* Metal-shell temperatures are measured in Zone "A" as shown on accompanying *Dimensional Outline.*

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.150	0.170	amp
Direct Interelectrode Capacitances:				
Grid to plate	2	1.8	2.6	pf
Input: G to (K,S,H)	2	3.8	4.6	pf
Output: P to (K,S,H)	2	1.4	1.8	pf
Cathode to plate	2	0.20	0.32	pf
Heater to cathode	2	1.2	1.8	pf
Plate Current (1)	1,3	5.0	9.5	ma
Plate Current (2)	1,4	–	50	μa
Transconductance	1,3	4000	8000	μmhos
Reverse Grid Current	1,5	–	0.1	μa
AC Emission	6,7	10	–	ma
Amplification Factor	1,3	20	40	
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,8	–	5	μa
Heater positive with respect to cathode	1,8	–	5	μa
Leakage Resistance:				
Between grid and all other electrodes tied together	1,9	1000	–	megohms
Between plate and all other electrodes tied together	1,10	1000	–	megohms
Useful Power Output	1,11	0.9	–	watt
Peak Cathode Emission Current (Pulsed)	1,12	250	–	ma

Note 1: With ac or dc heater volts = 6.3.

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With dc plate supply volts = 150, dc grid supply volts = 0, cathode resistor (ohms) = 560, cathode-bypass capacitor (μf) = 1000, and metal shell connected to ground.

Note 4: With dc plate volts = 150, dc grid volts = −15, and metal shell connected to ground.

Note 5: With dc plate supply volts = 100, dc grid supply volts = 1.7, grid-circuit resistance (megohm) ≤ 1 (the internal resistance of the current meter used for this measurement), and metal shell connected to ground.

Note 6: With ac or dc heater volts = 5.5.

Note 7: With dc plate supply volts = 50, dc grid supply volts = −5.7, 60-cps grid-signal volts (rms) = 7.5, dc resistance of transformer secondary winding in grid circuit ≤ 2 ohms, grid-voltage-supply bypass capacitor (μf) = 1000, and metal shell connected to ground. AC emission is measured as the dc component of plate current at these conditions.

Note 8: With dc heater-cathode volts = 100.

Note 9: With grid 100 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 10: With plate 300 volts negative with respect to all other electrodes tied together, and metal shell connected to ground.

Note 11: Measured at load in 250-Mc rf amplifier circuit with dc plate supply volts = 150, grid resistor (ohms) = 4700, driver power output (milliwatts) = 350, and plate milliamperes = 20.

Note 12: With dc plate supply volts = 250 and dc grid supply volts = −20. The grid is driven with pulse voltage, as follows: peak volts between grid and negative end of cathode resistor = 5, pulse repetition rate = 1000, pulse duration = 10 μs, pulse rise time ≤ 1 μs, and time of fall ≤ 1 μs. Peak cathode current is measured with a high impedance oscilloscope or equivalent device connected across a 1-ohm cathode resistor.

SPECIAL TESTS

Shock:

Peak Impact Acceleration. . . . . 1000 g

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand the specified Peak Impact Acceleration. Tubes are held rigid in each of four positions (X_1, X_2, Y_1, and Y_2) in a Navy Type, High-Impact (Flyweight) Shock Machine, and, with tube electrode voltages applied, are subjected to 20 blows (5 in each position) at the specified Peak Impact Acceleration.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Variable-Frequency Vibration.

Variable-Frequency Vibration:

This test is performed on a sample lot of tubes operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance, with the addition of a plate-load resistor of 2000 ohms. During operation, tube is vibrated in the X_1 position through the frequency range of 3000 to 15000 cycles per second with a constant vibrational acceleration of 1g. During the test, tube must not show an rms output voltage across the plate-load resistor in excess of:

25 millivolts over the frequency range of 3000 to 6000 cps
500 millivolts over the frequency range of 6000 to 15000 cps

Post-Impact and Post-Sweep-Frequency Fatigue Vibration limits:

35 millivolts over the frequency range of 3000 to 6000 cps
700 millivolts over the frequency range of 6000 to 15000 cps

Sweep-Frequency Fatigue Vibration:

This test is performed on a sample lot of tubes with only heater voltage of 6.3 volts applied. During operation, the tube is rigidly mounted and is vibrated through the frequency range of 5 to 500 cps and back to 5 cps. One such vibration sweep cycle takes approximately 15 minutes. The tubes are vibrated for a period of 3 hours along each of 3 mutually perpendicular axes for a total of 9 hours. The longitudinal axis of the tube is coincident with one of the 3 axes. The vibrations are applied as follows:

a From 5 to 50 cps with a constant peak-to-peak displacement of 0.080 inch.
b From 50 to 500 cps with a constant acceleration of 10 g.
c From 500 to 50 cps and then to 5 cps follows the procedure shown in *a* and *b*, but in reverse.

At the end of this test, tubes are criticized for Shorts and Continuity, Change in Transconductance, Reverse Grid Current, Heater-Cathode Leakage Current, and Vibration-Frequency-Vibration.

Low-Pressure Voltage Breakdown:

This test is performed on a sample lot of tubes to determine the ability of the tube to withstand high-altitude (low-air-pressure) conditions. Tubes are operated with 250 rms volts applied between the plate and all other electrodes and metal shell connected together. The tubes must not break down or show evidence of corona when subjected to air pressure equivalent to an altitude of 100,000 feet (8.0 ± 0.5 mm Hg).

Shorts and Continuity:

This test is performed on a sample lot of tubes from each production run. Tubes are subjected to the Thyratron-Type Shorts Test described in MIL-E-1D, Amendment 2, Paragraph 4.7.7, except that tapping is done by hand with a soft rubber tapper (Specifications for this tapper will be supplied on request). The areas of acceptance and rejection for this test are shown in the accompanying graph, *Shorts-Test Acceptance Limits*. Tubes are criticized for permanent or temporary shorts and open circuits.

Intermittent Conduction Life (1000 hours):

This test is performed on a sample lot of tubes from each production run to assure the high quality of individual tubes and to prevent epidemic failures due to excessive changes in tube characteristics. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, and plate dissipation = 1.5 watts (approx.), at a shell temperature of 150° C.

Tubes are criticized at 2 hours, 20 hours, and 100 hours for Inoperatives[h] and Transconductance, and at 500 hours and 1000 hours for Inoperatives[h] and Useful Power Output at 250 Mc.

Oscillator Life (1000 hours):

This test is performed on a sample lot of tubes to assure satisfactory operation of the tube as a 250-Mc oscillator. Tubes are operated with heater volts = 6.3 and plate dissipation = 1.4 watts.

Tubes are criticized at 500 and 1000 hours for Inoperatives[h] and Useful Power Output at 250 Mc.

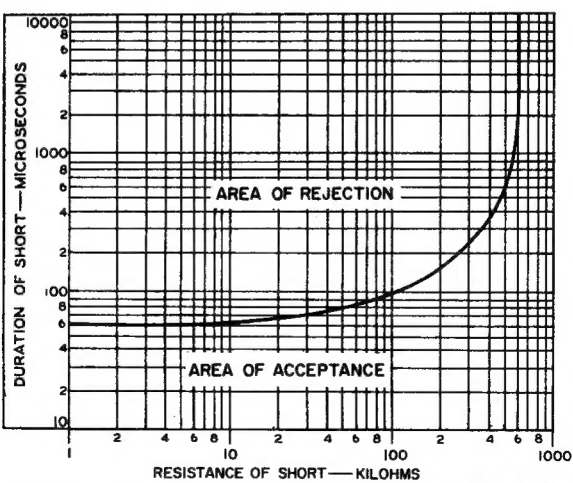
Grid Pulse Life (1000 hours):

This test is performed on a sample lot of tubes from each production lot. Tubes are operated with heater voltage of 6.3 volts cycled 110 minutes on and 10 minutes off, dc plate supply volts = 300, dc grid supply volts = -20, grid resistor (ohms) = 47, and plate-load resistor (ohms) = 330. The grid is driven with pulse voltage, as follows: peak grid-to-cathode volts = 5, pulse repetition rate = 1000, pulse duration = 10 μs, pulse rise time $\leq$ 1 μs, and time of fall $\leq$ 2 μs.

Tubes are tested at 500 hours and 1000 hours for Inoperatives[h] and Peak Cathode Emission Current (Pulsed).

[h] An inoperative is defined as a tube having a discontinuity, permanent short, or air leak.

SHORTS-TEST ACCEPTANCE LIMITS



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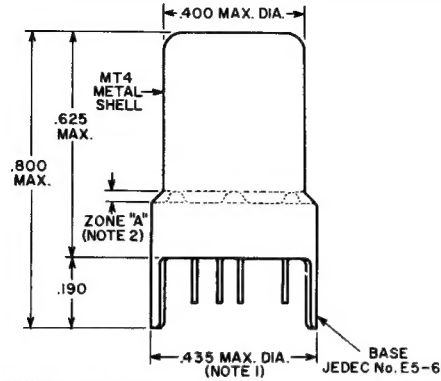
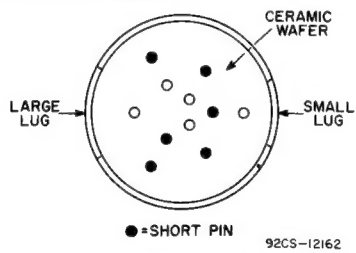
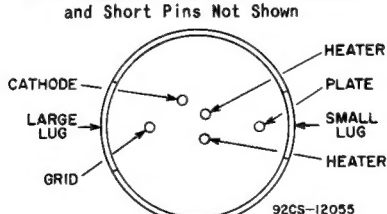


BOTTOM VIEW
Showing Arrangement of All 11 Base Pins



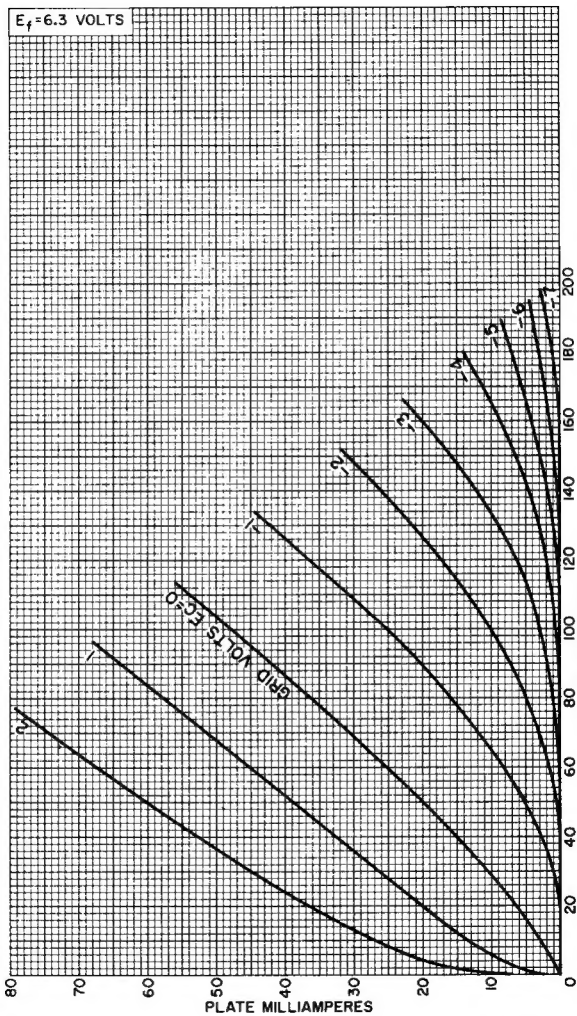
MODIFIED BOTTOM VIEW
With Element Connections Indicated and Short Pins Not Shown



Note 1: Maximum outside diameter of 0.440" is permitted along 0.190" lug length.

Note 2: Metal-shell temperature should be measured in zone "A".

AVERAGE PLATE CHARACTERISTICS



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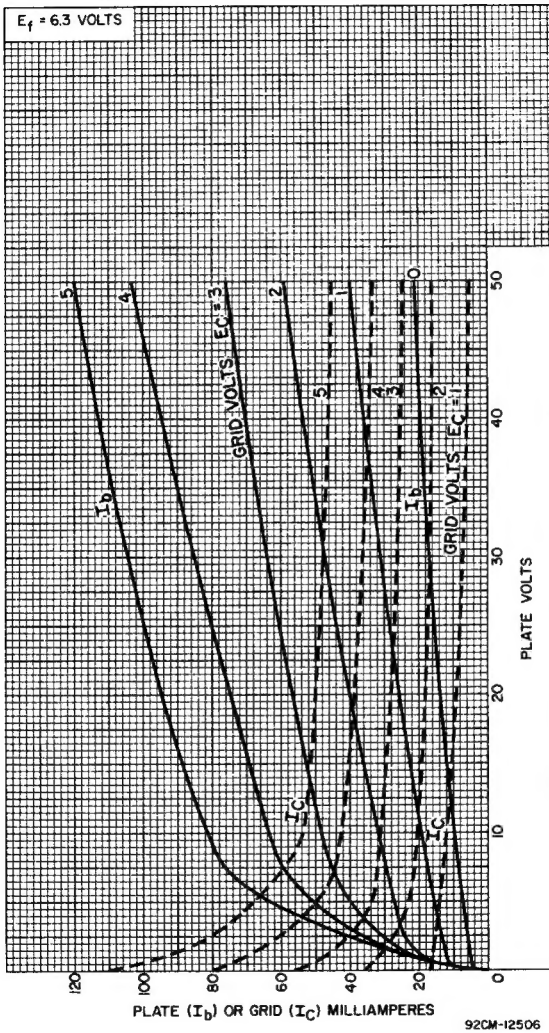
AVERAGE CHARACTERISTICS



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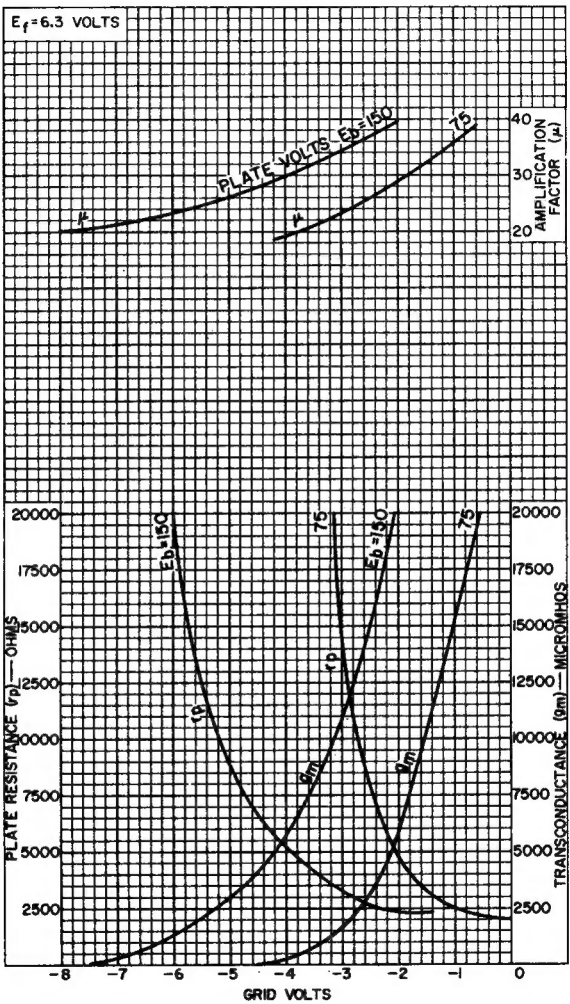
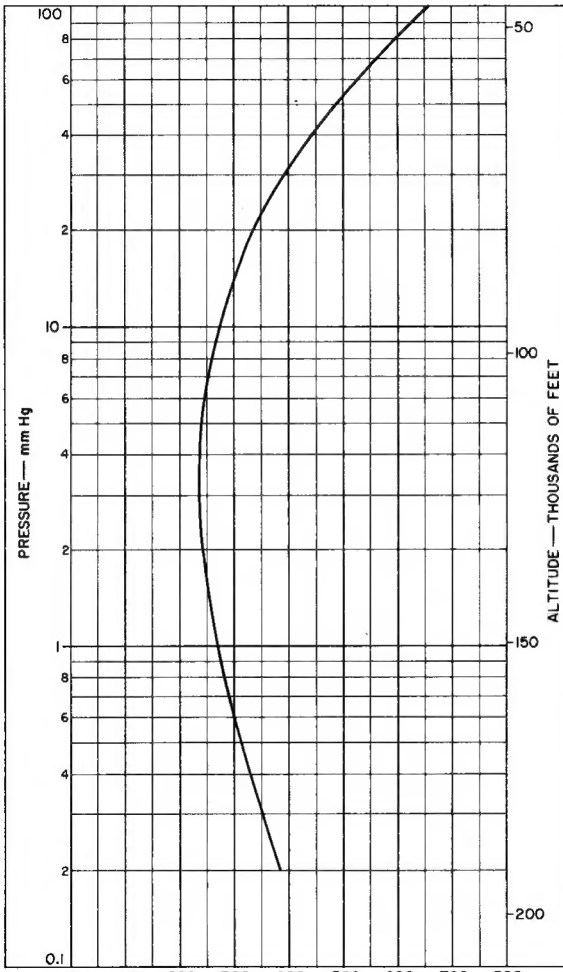


LOW-PRESSURE VOLTAGE-BREAKDOWN CHARACTERISTICS OF NUVISTOR TRIODE BASE



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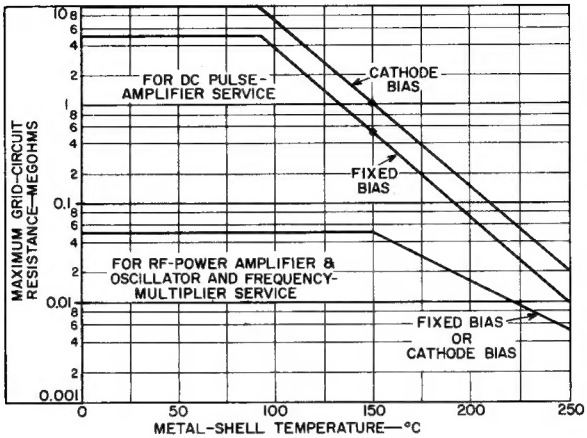
GRID-CIRCUIT-RESISTANCE RATING CHART



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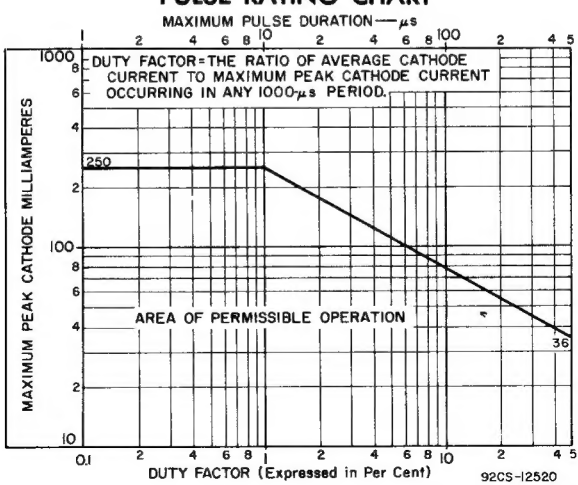
PULSE RATING CHART



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